MECHANICS.

222. Proposed by W. J. GREENSTREET, Stroud, England.

Find the maximum angle of inclination to the line of greatest slope of a uniform rod resting on a rough inclined plane and capable of turning freely round a point on it.

II. Solution by the PROPOSER.

Let the point on the rod about which it turns be distant x and y from the ends $(x>y)$. Let α be the inclination of the plane, and θ the angle the rod in its initial position makes with the greatest line of slope. Let W be the weight per unit length of the rod. Consider the normal reactions as acting at the mid points, respectively, of AO, OB, where AB is the rod and O the pivot. μ is the coefficient of friction.

Resolving perpendicular to the plane for each part AO, OB,

$$R=\frac{x}{2}W\cos\alpha, \qquad R'=\frac{y}{2}W\cos\alpha.$$

There is an unknown force at O. Take moments at O,

$$\mu.\frac{x}{2}R-\frac{x^2}{4}W\sin\alpha\sin\theta+\mu.\frac{y}{2}R'+\frac{y^2}{4}W\sin\alpha\sin\theta=0,$$

and substituting for R, R,

$$\mu\frac{x^2}{4}.W\cos\alpha+\mu\frac{y^2}{4}W\cos\alpha=\frac{W\sin\alpha\sin\theta}{4}(x^2-y^2),$$

$$\mu\cot\alpha\,(x^2+y^2)=\sin\theta\,(x^2-y^2).$$

$$\therefore\sin\theta=\mu\cot\alpha\frac{x^2+y^2}{x^2-y^2}, \qquad \theta=\sin^{-1}\left(\mu\cot\alpha.\frac{x^2+y^2}{x^2-y^2}\right).$$

224. Proposed by G. B. M. ZERR, A. M., Ph. D., Philadelphia, Pa.

A steel clock spring $w=\frac{7}{8}$ inch wide, $t=\frac{1}{32}$ inch thick, is wound around an axle $d=\frac{1}{4}$ inch in diameter. Find the greatest available moment for running the clock, using a factor of safety $f=6$.

Solution by the PROPOSER.

Let $OH=r$=radius of curvature; $HL=y$=distance of any fiber from the gravity axis HH; x=length LM of this fiber; $MS=dx$; $RH=z$=distance between the neutral axis and the gravity axis; $\angle MRS=\phi$, $\angle AOB=\theta$; $s=$